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Guidelines for Packaging Frozen Edible Offal for Export

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Guidelines for Packaging Frozen Edible Offal For Export

By Mark T. Turczyn[1]

Introduction

In 1973, the United States exported 127,860 metric tons, approximately $88 million, of edible offal. By 1978, the total had increased to 185,831 metric tons, approximately $205 million.[2] These edible offal, commonly referred to as variety meats, included such products as beef livers, tongues, and hearts, and pork livers and hearts. The U.S. Meat Export Federation (USMEF) purchasing guide[3] shows examples of these exported variety meats.

Since 1970, exporters of edible offal have experienced a rejection rate ranging from 5 to 30 percent.[4] It is possible that this rejection rate hurts not only current sales, but also may influence future sales by inferring that U.S. variety meats are not equal in quality to meats from exporting countries with much lower rejection rates. USDA personnel stationed in Rotterdam, the Netherlands, indicate that the majority of the rejections, as well as the designation "unfit for human consumption," are based on the arrival appearance of the shipping containers holding the variety meat, rather than on the meat itself. Excessive blood stains on the outside of shipping containers and crushed and broken-open shipping containers, as well as inadequately closed shipping containers, are all problem areas that cause rejection or lower the value of U.S. variety meats. Even frost on the container's exterior causes downgrading or rejection, because to European inspectors, frost indicates that meat has thawed in transit.[5] This report outlines the factors which cause the shipping containers to break down. It also provides suggestions on how to prevent excessive container breakdown, thus ensuring good container appearance at export destination.

[1] General engineer, Transportation and Packaging Research Branch, Office of Transportation, U.S. Department of Agriculture (USDA), Beltsville, Md. 20705.

[2] Foreign Agriculture Circular, FLM MT 7-79, April 1979.

[3] "Variety Meats from the U.S.A.—A Purchasing Guide," USMEF, Denver, Colo., 1979.

[4] Personal correspondence with members of USMEF.

[5] Personal correspondence with USDA research personnel in Rotterdam, The Netherlands.

Common Packaging and Handling Deficiencies

Deficiencies in prehandling, packaging (style, size, and choice of material), freezing, and materials handling are the basic reasons U.S. frozen variety meats arrive in Europe having an appearance inferior to that of variety meats exported from other countries. These deficiencies can be avoided with a minimal amount of effort. It is very important to understand that these four areas contribute equally to the arrival condition of the meat container at its export destination. They are interrelated; a deficiency in one area will influence how the others provide needed product protection.

Improper prehandling methods lead to soggy, broken-down shipping containers. If all cavities and folds are not completely drained of blood, water, and fluids before the variety meat is placed in a shipping container, seepage and staining will weaken the corrugated fiberboard shipping container (fig. 1). Improper prehandling techniques can ruin the best container. This applies even if the variety meat is placed in a polyethylene bag.

When completely frozen, variety meats have an inherent stacking strength and resistance to impact. If the meat is not completely frozen, the shipping container must provide the additional stacking strength and shock protection normally provided by the frozen product, and a much more expensive shipping container is required.

The inherent stacking strength and shock resistance of frozen variety meats influence the style and construction material chosen for the shipping container. The frozen product and the shipping container work together to prevent damage to either the meat or the shipping container. It was observed during surveys at originating and destination ports that a two-piece, full-telescope style[6] shipping container constructed with a minimum of 200-pound test[7] corrugated fiberboard generally provided the protection needed during storage, handling, and distribution of variety meat products weighing under 30 pounds net when packed. For variety meats packed over 30 pounds net, a two-piece, full-telescope style shipping container constructed from

[6] See appendix.

[7] See Mullen Test, appendix.

Figure 1.—A blood-soaked container.

Figure 2.—"Frozen-in" bottom bulges hinder square, secure stacking.

Figure 3.—Containers crushed down because of oversizing.

corrugated fiberboard having a minimum test weight of 275 pounds provided the needed protection. Containers that weighed over 70 pounds received extremely rough treatment because of the body strength needed to handle them. Even 275-pound test weight corrugated board was inadequate. Closing the containers with the use of nonmetallic strapping prevented the containers from being cut and torn and also helped to maintain the containers' integrity.

Shipping containers built to the above specifications will be strong enough to prevent side or bottom bulges when they are filled with un-

Figure 4.—Top bulges caused by undersized container.

frozen variety meat and then placed in a freezer. Weak containers, or ones not fully supported on the bottom during freezing, bulge from the weight of the unfrozen variety meat. These bulges set in during freezing and prevent the shipping container from being stacked squarely and securely during storage, handling, and transport (fig. 2).

Along with style and construction material, correct sizing of the shipping container is important when using the inherent strength of the frozen meat. It is difficult to take advantage of the variety meat's inherent stacking strength and impact resistance if it is packed in an oversized corrugated fiberboard shipping container. Occasional frost formation and subsequent defrosting, coupled with high humid conditions of the distribution system, soften and weaken the corrugated fiberboard; therefore, oversized fiberboard corrugated shipping containers quickly crush and break down (fig. 3). Undersizing the container is also undesirable. An undersized container acts only as a covering for the meat; it does not provide stacking strength. The frozen meat overfills the container and therefore it alone supports the load. The irregular shapes caused by overfilling prevent safe unitizing, handling, and storage (fig. 4).

A correctly sized, designed, constructed, and closed shipping container works in harmony with the strength of the frozen meat. It will prevent contamination and pilferage and ensure square stacking alignment and a good marketing appearance.

Improper handling also causes package damage. A typical system-flow diagram for exporting frozen variety meats in breakbulk is shown in figure 5. The variety meat package is handled a minimum of seven times. It is placed in storage in at least three warehouses and experiences two to three transport modes. It experiences shock, vibration, fluctuations in temperature and humidity,and large stacking forces. Even strong, well-designed shipping containers break down when exposed to abusive handling, storage, and inadequate blocking and bracing during

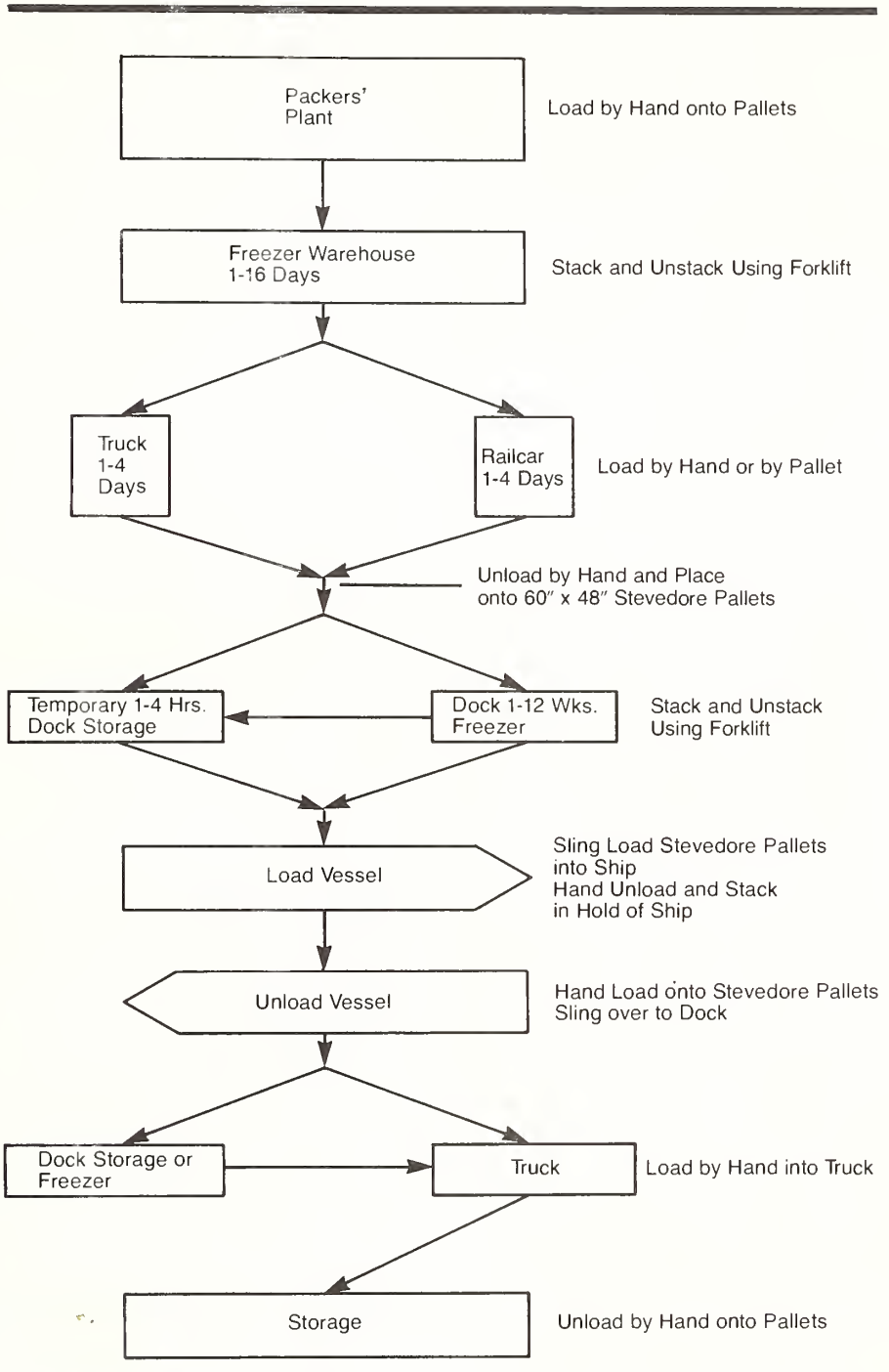

Figure 5.—Typical breakbulk distribution system for variety meats.

transit. Containers that are allowed to slam around loosely during transit, are unloaded by being tossed 3 to 4 feet, and then are stacked 15 feet high, usually have a poor appearance at destination. Correct blocking and bracing during transit, coupled with proper breakbulk storage, loading, and unloading methods, will prevent much container damage (fig. 6). The best materials-handling method is unitizing, with either pallets or slipsheets and shrink or stretch film (fig. 7). The film also protects the shipping containers from external contamination, such as blood from other leaking shipping containers.

The use of mechanical handling equipment, such as forklift trucks, at each carrier interface eliminates much manual rough handling. Mechanical handling also ensures square stacking and alignment of pallets and shipping containers, thus taking full advantage of the meat package's ability to withstand compression weights during handling and storage within the export distribution environment. Lastly, using mechanical handling at each interface reduces the amount of time the meat and containers are exposed to ambient temperatures and high relative humidity. These conditions cause condensate to form on the surface of the shipping container, which in turn may weaken it. Mechanical handling of whole pallet loads also reduces the surface area of containers in contact with ambient temperatures.

Giving equal attention to each of the four areas discussed will ensure the successful arrival of packaged frozen variety meat at its export destination.

Figure 6.—Container damage caused by inadequate blocking and bracing.

Figure 7.—A good unitized load of meat.

Minimum Packaging And Materials-Handling Recommendations

The following represent minimum recommendations which the author believes would ensure good shipping container appearance at export destination. All these recommendations work together to protect the meat and the shipping container. Ignoring one or two of them may allow the shipping container to incur damage.

Prehandling of Meat

Prior to packaging, all variety meats should be chilled thoroughly and drained completely of blood, water, and fluids. All cavities and folds must be emptied to prevent seepage, staining, and weakening of the shipping container.

Packaging

Bags: The meat should be placed in a polyethylene bag having a minimum wall film thickness of 3 mils. The bag should be closed by a positive seal method, such as use of a twist tie or heat sealing.

Shipping Containers: *Dimensions*—The variety meat should completely fill the shipping container. Headspace or side voids exceeding one-half inch should not be tolerated. An outside dimension which effectively uses a 120- by 100-cm pallet is encouraged. Four strongly recommended container sizes which fit this pallet are 40 by 30 cm, 50 by 30 cm, 50 by 40 cm, and 60 by 40 cm. Other container dimensions can be found in table 1, appendix, and in the American National Standard Institute's proposed MH10.1-M-1980 "American National Standard for Unit-Load and Transport Package Sizes."

Construction Material—For packages under 30 pounds, use 200-pound test minimum, water-resistant,[8] corrugated fiberboard, bound with waterproof adhesives. This, or an equivalent-rated fiberboard, is acceptable. For packages over 30 but not exceeding 70 pounds, use 275-pound test minimum, water-resistant, corrugated fiberboard, bound with waterproof adhesives. An equivalent fiberboard is also acceptable. Conditions of high humidity prevalent during storage, handling, and transport require the use of water-resistant or waterproof fiberboard. Without this protection, corrugated fiberboard quickly loses its ability to support loads. Untreated, a corrugated container can only support one-half the load at 80-percent relative humidity that it can at 50-percent relative humidity. Regardless of the ambient relative humidity, when an untreated box of frozen meat is placed in ambient air above freezing, condensation will form on the box and weaken it. This condensation also causes frosting, which may lead European inspectors to suspect that the meat had thawed in transit. Downgrading or rejection of the

[8] See appendix.

Table 1—Sample printout of how containers of different sizes may be placed upon pallets of different sizes.

Maximum Pallet Length = 120	Maximum Number of Units/Layer = 12	Minimum Unit Length = 40
Maximum Pallet Width = 100	Minimum Number of Units/Layer = 4	Minimum Unit Width = 30
Minimum Pallet Length = 120	In-Surface Utilization = 95	Increment of Unit = 1
Minimum Pallet Width = 100	Maximum Unit Length = 60	
Increment of Pallet = 1	Maximum Unit Width = 40	

Number of Units per Layer	Number of Unit L's along Pallet L	Number of Unit W's along Pallet L	Number of Unit L's along Pallet W	Number of Unit W's along Pallet W	Pattern Type	Effic-iency	Pallet Length	Pallet Width	Unit Length	Unit Width
6	0	3	0	2	Type-T	96.00	120	100	48	40
6	0	3	0	2	Type-T	95.55	120	100	49	39
6	0	3	0	2	Type-T	98.00	120	100	49	40
6	0	3	0	2	Type-T	95.00	120	100	50	38
6	0	3	0	2	Type-T	97.50	120	100	50	39
6	0	3	0	2	Type-T	100.00	120	100	50	40
6	2	0	3	0	Type-T	95.70	120	100	58	33
6	2	0	3	0	Type-T	97.35	120	100	59	33
6	2	0	3	0	Type-T	96.00	120	100	60	32
6	2	0	3	0	Type-T	99.00	120	100	60	33
7	1	2	2	3	Type-A	96.25	120	100	50	33
8	0	4	0	2	Type-T	96.00	120	100	48	30
8	0	4	0	2	Type-T	98.00	120	100	49	30
8	0	4	0	2	Type-T	100.00	120	100	50	30
9	3	0	3	0	Type-T	96.00	120	100	40	32
9	3	0	3	0	Type-T	99.00	120	100	40	33
5	2	3	1	1	Type-B	95.00	120	100	57	40
5	2	3	1	1	Type-B	96.66	120	100	58	40
5	2	3	1	1	Type-B	95.87	120	100	59	39
5	2	3	1	1	Type-B	98.33	120	100	59	40
5	2	3	1	1	Type-B	95.00	120	100	60	38
5	2	3	1	1	Type-B	97.50	120	100	60	39
5	2	3	1	1	Type-B	100.00	120	100	60	40
10	3	4	1	2	Type-B	100.00	120	100	40	30

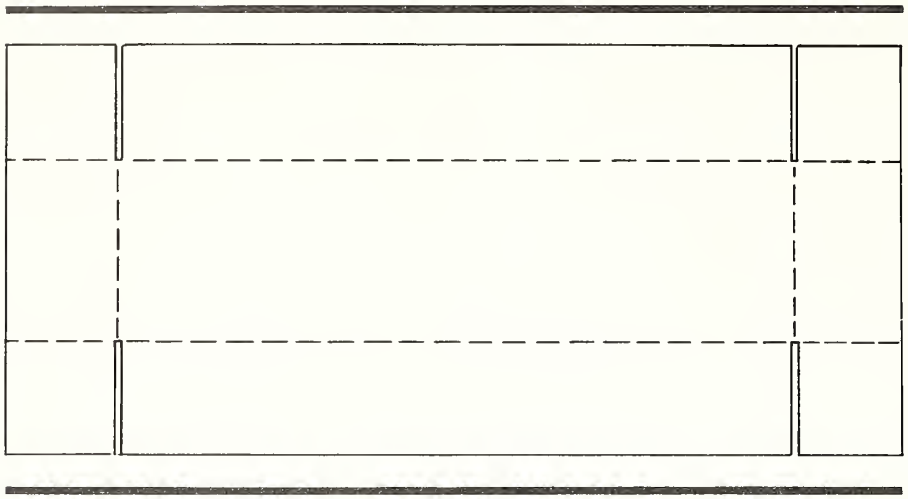

Figure 8.—Top of two-piece, full-telescope shipping container.

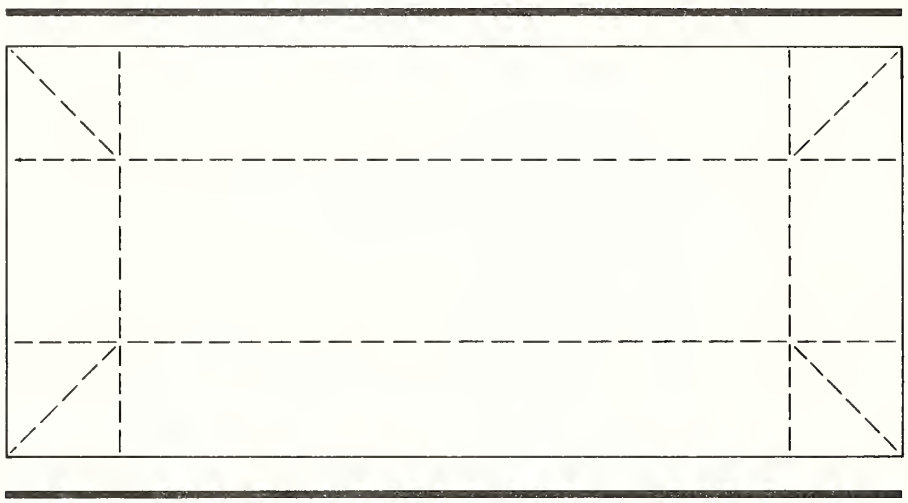

Figure 9.—Bottom of two-piece, full-telescope shipping container with diagonally scored bellows, folding leakproof corners.

meat sometimes is the result of such suspicions.

Style—A two-piece, full-telescope (International Box Code 0301)[9] shipping container with bellows, nonleak bottom is acceptable for the retail market. This may be either a slotted or die-cut configuration (figs. 8, 9, 10, and 11). Use a glued or interlock assembly as applicable. Do not use metal staples or stitches. For the meat-processor market, a one-piece, folded, interlocked container (International Box Code 0761) is acceptable.

Closure Methods—Closure should be achieved using a minimum of two nonmetallic straps, 3/8-inch minimum width, banded girthwise. Metal bands, wire, or very thin plastic straps may cut the shipping containers when longshoremen use them to pick up the containers. High humidity causes reinforced tape to pull away and drop off the shipping containers. The use of hot melted glue is an acceptable closure method for the two-piece, full-telescope container, provided that the glue chosen will sufficiently penetrate the corrugated fiberboard to prevent "pulling away" when exposed to high humidity.

Freezing

If possible, the meat should be form-frozen to match the dimensions and shape of the shipping container prior to packing. If this is not possible, shipping containers not strong enough to prevent prefreeze bulging should be fully supported by internal corrugated inserts and/or full-face freezer boards. Correct stacking methods should be used, such as the stacking of containers with their sides aligned vertically. The meat should be frozen completely before it is removed from the freezer.

Unitizing and Palletizing

The shipping containers should be placed upon a four-way entry pallet or slipsheet (120 by 100 cm) and then stretched or shrink-wrapped with applicable plastic stretch or shrink film.

[9] See appendix.

Marking, Labeling, and Foreign Requirements for Export

Frozen variety meat for export should meet inspection, packaging, labeling, and marketing requirements outlined in the "Meat and Poultry Inspection Manual," Parts 22-A, B, and C.[10]

In summary, the following practices will help ensure safe arrival of the shipping container at destination:

1. Drain all excess fluids from the variety meats.
2. Place meat in a polyethylene bag and secure with tie, heat sealing, etc.
3. Use a freezing method or shipping container that is strong enough to prevent frozen-in bottom or side bulges.
4. Ship the meat completely frozen and maintain freezing temperature throughout the distribution system.
5. Do not overfill or underfill the shipping container.
6. Use 200-pound test, water-resistant, corrugated fiberboard for shipping containers carrying under 30 pounds net of meat. Use 275-pound test for over 30 pounds net of meat.
7. Net weight of meat per box should not exceed 70 pounds.
8. Use a two-piece, full-telescope style container with bellows and a nonleak bottom.
9. Use a water-resistant glue—not staples or stitches—to construct the shipping container.
10. Use only wide, nonmetallic strapping. Do not use metal bands, wire, very thin plastic straps, or filament tape to close the shipping containers.
11. Use some form of unitization, such as a pallet, with stretch film around the shipping containers.
12. Block or brace the shipping containers properly during railcar, trailer, or containerized shipment.

[10] USDA, MPI-7.

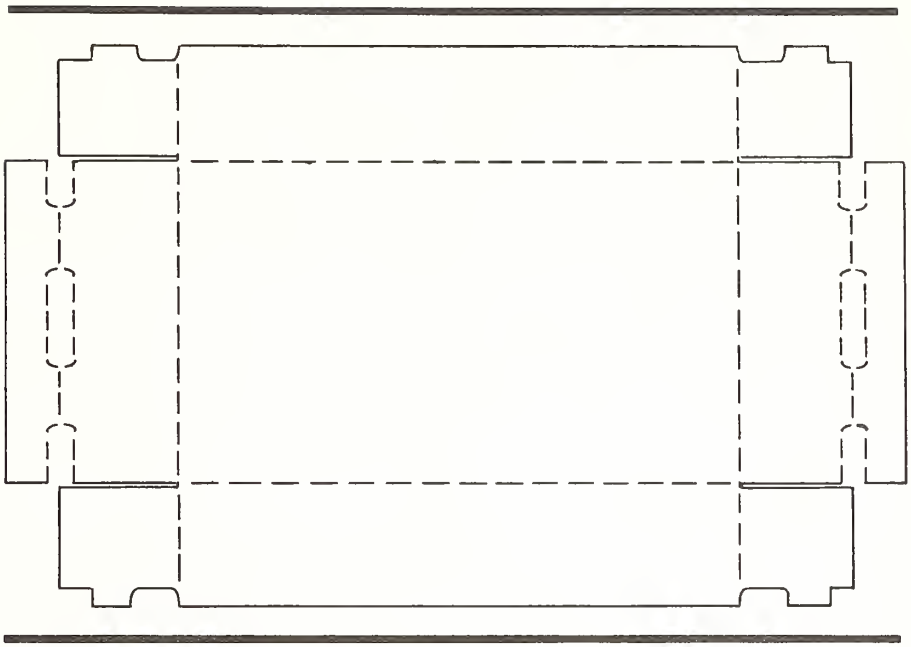

Figure 10.—Top of die-cut, two-piece, full-telescope shipping container.

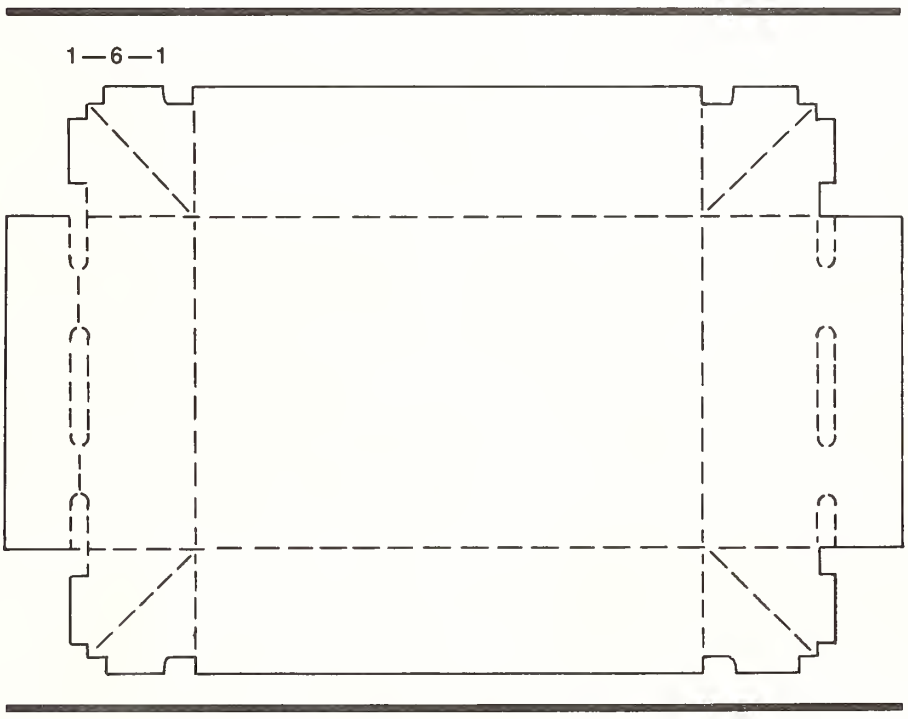

Figure 11.—Bottom of die-cut, two-piece, full-telescope shipping container with diagonally scored bellows, folding leakproof corners.

Appendix

In the text of the report, the author used a number of terms that the reader may not recognize. A working knowledge of packaging terms used in specifying fiberboard shipping containers is essential when discussing packaging needs with a container manufacturer. The appendix discusses briefly terms that are important when choosing a shipping container. General packaging and materials-handling terms are defined in booklets such as "The Glossary of Packaging Terms,"[11] and "The Fibrebox Handbook."[12]

Dimensions

All manufacturers measure and specify shipping containers according to the inside dimensions. The packinghouse agent should be aware that outside dimensions are important in determining how a container will cover a pallet or shipsheet for unitized handling.

Style

Six basic styles of shipping containers are in use. The European Federation of Manufacturers of Corrugated Board (FEFCO) and European Solid Fiberboard Case Manufacturers Association (ASSCO) developed an international fiberboard case code that specifies construction styles or types of boxes (fiberboard shipping containers).[13] These styles, shown in figures 12 through 17, can be cut using dies or regular slitting equipment.

Slotted-type boxes (fig. 12) consist of one piece with a stitched, taped, or glued manufacturer's joint and top and bottom flaps. They are shipped flat, ready-to-use, and the flaps require closing.

Telescope-type boxes (fig. 13) consist of more than one piece and are characterized by a lid and/or bottom that telescopes over the body of the box.

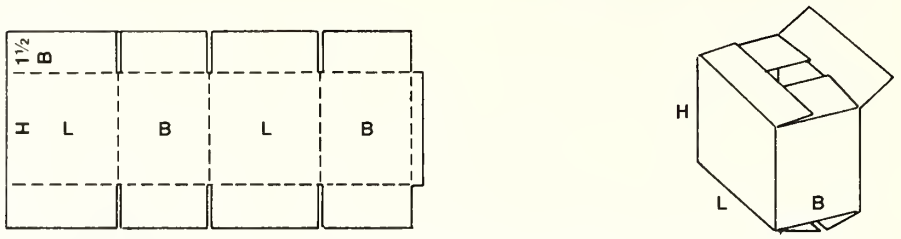

Figure 12.—Slotted-type box.

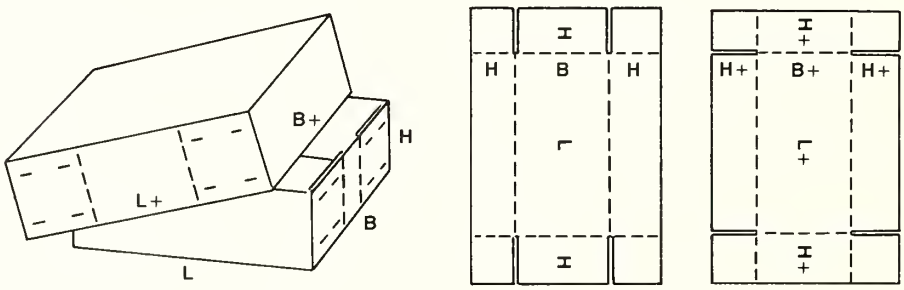

Figure 13.—Telescope-type box.

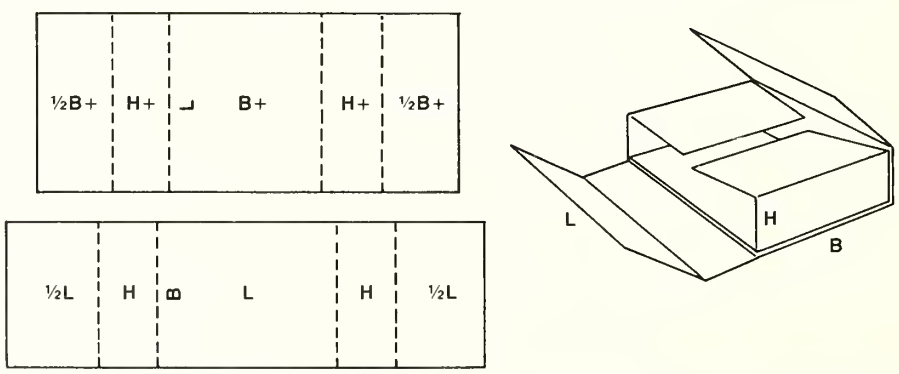

Figure 14.—Folder-type box.

[11] The Packaging Institute, Inc., 342 Madison Ave., New York, N.Y. 10017.

[12] The Fibrebox Association, 224 South Madison Ave., Chicago, Ill. 60604.

[13] International Fibre Board Case Code, FEFCO, ASSCO.

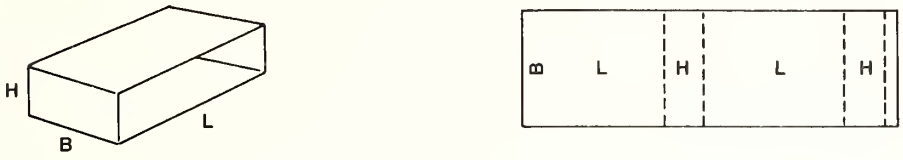

Figure 15.—Slide-type box.

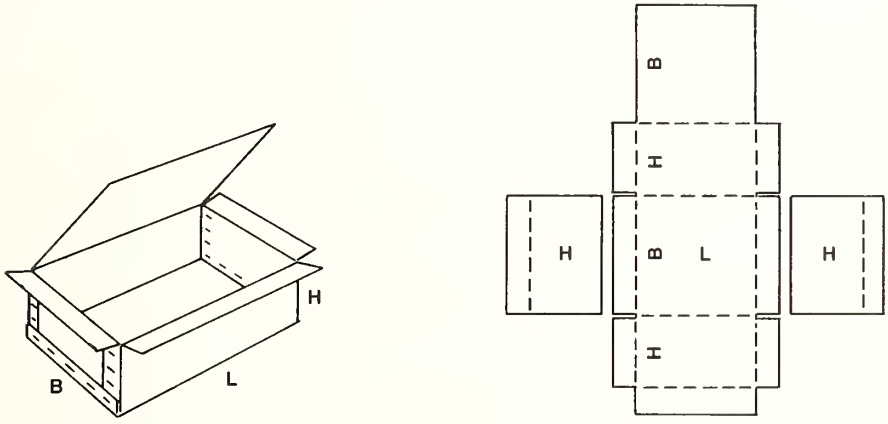

Figure 16.—Rigid-type box.

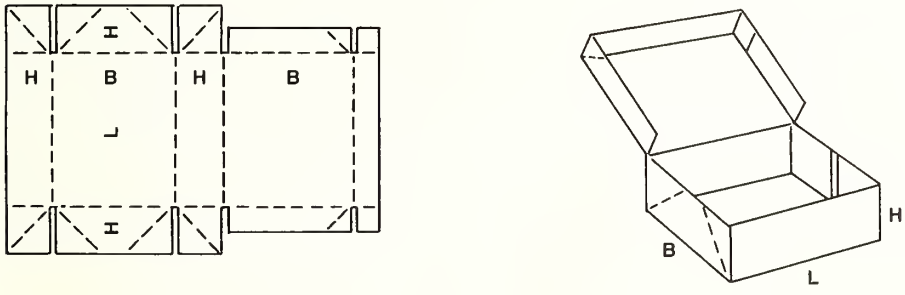

Figure 17.—Ready-glued box.

Folder-type boxes (fig. 14) usually consist of only one piece of board. The bottom of each box is hinged to form two or all sidewalls and the cover. The boxes can be set up without stitching or taping. Locking tabs, handles, display panels, etc., can be incorporated into the design.

Slide-type boxes (fig. 15) consist of several pieces of liners and sleeves sliding in different directions into each other. The group also includes outside sleeves for other cases.

Rigid-type boxes (fig. 16) consist of two separate end pieces and a body. They require glue or stitching (or a similar operation) before they can be used.

Ready-glued boxes (fig. 17) consist of one piece, are shipped flat, and are ready to use when set up.

Custom-made, die-cut containers are often of the same style as presented above. They are cut from fiberboard sheets of material (see figs. 4 and 5) with a metal die that is similar to a cookie cutter. Often they are set up without the use of glue or stitches.

Fabrication Material

Most shipping containers for variety meats are made from either solid or corrugated fiberboard. A paper product made from wood, often called container board, is the principal material used. Laminating two or more plies of container board produces solid fiberboard. Corrugated fiberboard consists of one piece of fluted (corrugated medium) container board sandwiched between two flat sheets of container board (liner board). Single-wall corrugated fiberboard has only one layer of fluted container board (corrugated medium) and two facings (fig. 18); double-wall corrugated fiberboard has two corrugated mediums and three facings (fig. 19); and triple-wall corrugated fiberboard has three corrugated mediums and four facings (fig. 20).

The number and thickness of the layers and the type of binder determine the strength of solid fiberboard. The number and size of flutes per linear foot and the thickness or basis weight of the linear board determine the strength of the corrugated fiberboard. The quality of the adhesive also can make a difference.

Types of Flutes

Flutes are graded as follows:

	Number per linear foot	Approximate heights[14]
A-flute	36 ± 3	3/16 inch
B-flute	50 ± 3	3/32 inch
C-flute	42 ± 3	9/64 inch
E-flute	94 ± 4	3/64 inch

Water-Resistant Coatings

Because shipping containers must maintain their stacking strength in humid conditions, corrugated fiberboard may be coated or impregnated with waxes, plastics, or chemicals to prevent deterioration from moisture.

[14] These heights do not include thickness of facings.

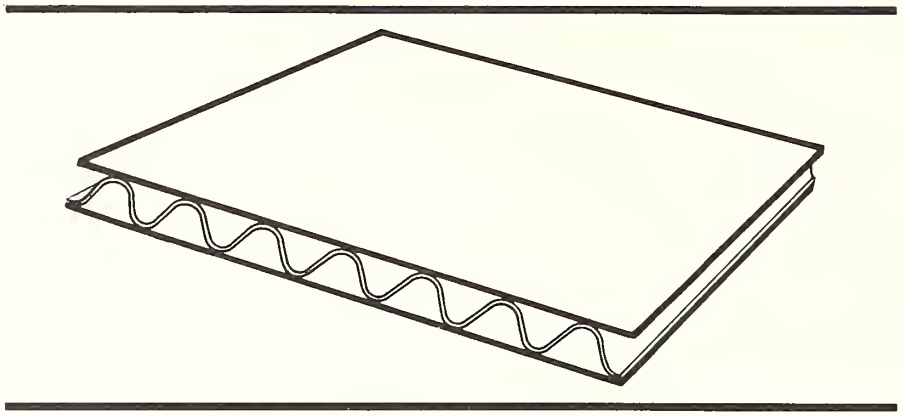

Figure 18.—Single-wall corrugated fiberboard.

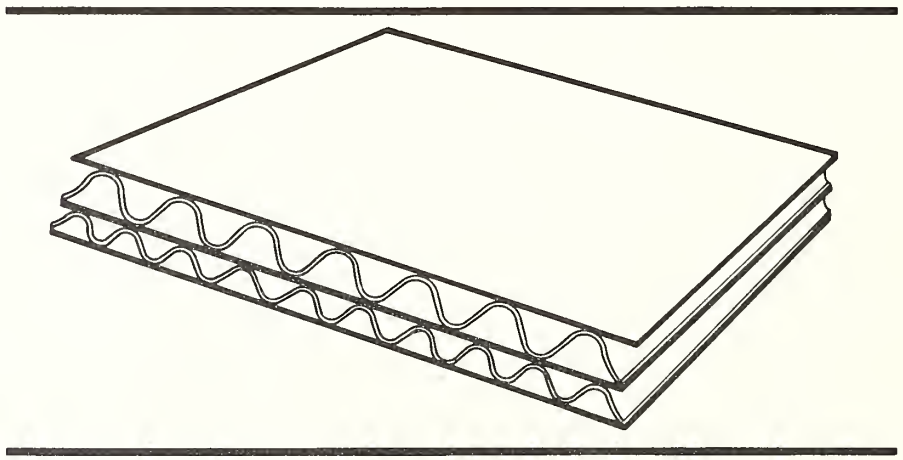

Figure 19.—Double-wall corrugated fiberboard.

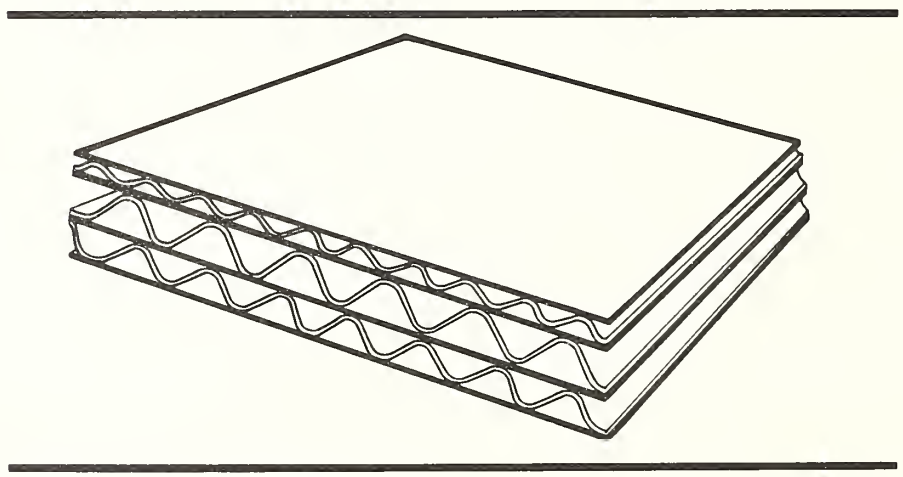

Figure 20.—Triple-wall corrugated fiberboard.

Material Tests

To rate one type of construction against another, tests are performed to determine the effects on fiberboard of various linear board weights, adhesives, flutes, and other material and construction differences. The most commonly referenced material test is the "Mullen" bursting test. The data generated by this test represent the pressure at which the Mullen test machine "bursts" through both surfaces of a piece of fiberboard. The most common single-wall, corrugated bursting strength categories are: 125, 175, 200, 275, and 350 pounds per square inch.

Other types of material tests are "Beach Puncture," "Ring Crush," and "Short-Column Crush Test." While often used to estimate compression strength and durability of a finished container, data derived from material tests such as the Mullen give only rough approximations of a shipping container's durability.

Performance Tests

The performance of a shipping container during storage, handling, and transport can be judged in laboratory tests. Compression testing, drop testing, and vibration testing are examples. These tests are described in ASTM Standard Part 20.[15] Many of them are performed under "ideal" laboratory conditions, so undertaken that data obtained by several laboratories may be correlated. The tests, therefore, only estimate the durability of a shipping container, and cannot guarantee how it will respond during actual handling, storage, and transport. One attempt to expose shipping containers to more realistic environments is described in the ASTM proposed "Recommended Practices for Performance Testing of Shipping Containers."[15] The shipping container is subjected to a series of performance tests which reflect the type and harshness of the force experienced by the shipping container at each step in the distribution system.

[15] American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.